Constructing Triangles from Three Measurements

Explore ideas and representations

Name _____ **Date** _____ **Score** _____ / 6

QUICK REVIEW

A nonflat triangle requires the two shortest sides to sum to more than the longest. Equality gives a straight, collapsed figure. Three side lengths (SSS) determine one triangle shape when they close; its mirror image is the same shape. Each square on a construction grid represents 1 cm on a side.

Worked example

Can $2, 4, 6$ cm form a nonflat triangle?

1. The two shortest sides total $2 + 4 = 6$ cm.
2. That equals the longest side, 6 cm; it is not greater.
3. The segments lie flat, so enclosed area is 0 cm^2, not a triangle.

Answer: No.

Practice Problems

Show your thinking.

1. Can segments of lengths $3, 4, 5$ cm form a triangle? Test the two shortest sides. If possible, describe a compass construction using the longest side as base. If possible, show the full-size ruler-and-compass construction on a separate sheet of centimeter-grid paper. Leave your arcs visible.

2. Can segments of lengths $2, 3, 6$ cm form a triangle? Test the two shortest sides. If possible, describe a compass construction using the longest side as base.

3. On the grid, construct a triangle with 4 cm and 5 cm sides meeting at $90°$. Use the longer leg as the base. Do the measurements determine one shape? Find its area.



4. Can segments of lengths $2, 5, 7$ cm form a triangle? Test the two shortest sides. If possible, describe a compass construction using the longest side as base.

5. On the grid, construct a triangle with a 5 cm horizontal base and both base angles $60°$. Find the third angle and explain how many shapes satisfy these measurements.



6. Two rods are 5 and 8 cm. Find all whole-cm lengths for a third rod that can complete a nonflat triangle.

Answer Key

1. Yes. Base 5 cm; arc radii 3 and 4 cm.
2. No triangle.
3. One SAS shape up to flipping; area 10 cm^2.
4. No triangle.
5. Third angle 60°; one equilateral shape, sides 5 cm.
6. Whole-cm third lengths 4 through 12.

Step-by-Step Solutions

Follow each calculation, then check your own work.

Problem 1

1. Two shortest lengths sum to $3 + 4 = 7$ cm.

2. Compare with longest 5 cm: $7 > 5$.

3. Draw a 5 cm base. Swing an arc of radius 3 cm from one end and 4 cm from the other. Join their intersection to both ends.

Problem 2

1. Two shortest lengths sum to $2 + 3 = 5$ cm.

2. Compare with longest 6 cm: $5 \leq 6$.

3. The two shorter segments cannot meet.

Problem 3

1. Draw a horizontal 5 cm base. At one end draw a vertical ray to form 90°.

2. Mark 4 cm on that ray, then join the two free endpoints.

3. Area $= (1/2)(5)(4) = 10$ cm^2; the two sides and included angle fix one shape.

Problem 4

1. Two shortest lengths sum to $2 + 5 = 7$ cm.

2. Compare with longest 7 cm: $7 \leq 7$.

3. The segments lie flat.

Problem 5

1. Two base angles sum to $60 + 60 = 120^\circ$.

2. Third angle $180 - 120 = 60^\circ$, so all three angles match.

3. Draw base 5 cm; 60° rays from its ends meet at the third vertex. All sides equal 5 cm, so the shape is unique up to reflection.

Problem 6

1. Triangle inequalities give $x > 8 - 5 = 3$.

2. Also $x < 8 + 5 = 13$.

3. Whole lengths are $4, \ldots, 12$; lower equality and upper equality would both make a flat figure.

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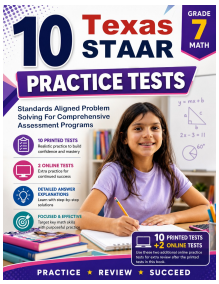

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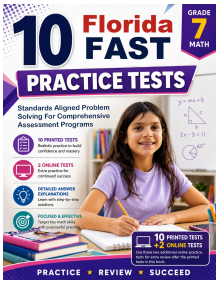

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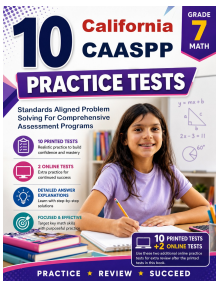

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